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GB A 2156252 GB 1090858 US 4460034
GB 1548007 GB 0903420

(58) Field of search
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Selected US specifications from IPC sub-class B22D

(54) Continuous casting mould

(57) Because the thermal strain in the mould is most intensive in the region where the boundary of the molten metal fluctuates, it is advantageous that a cooling as efficient as possible is arranged especially in the region of the molten metal boundary.

The mould (1) is thus provided with grooves (2), which are advantageously formed in the working operation of the mould tube blank.

Fig. 1

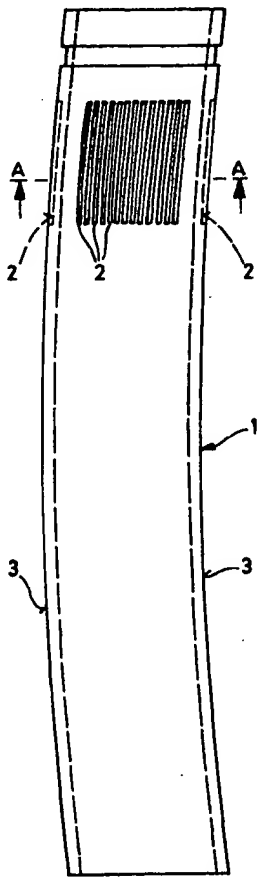

Fig. 3 (A-A)

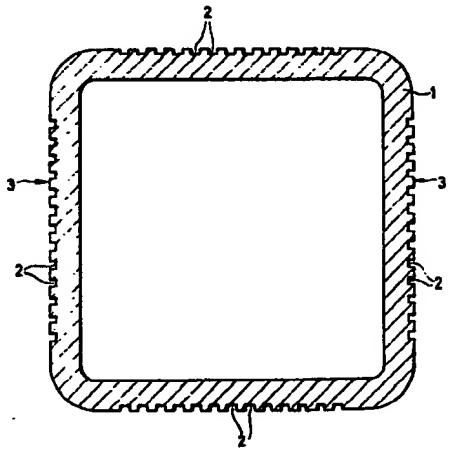

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Fig. 1

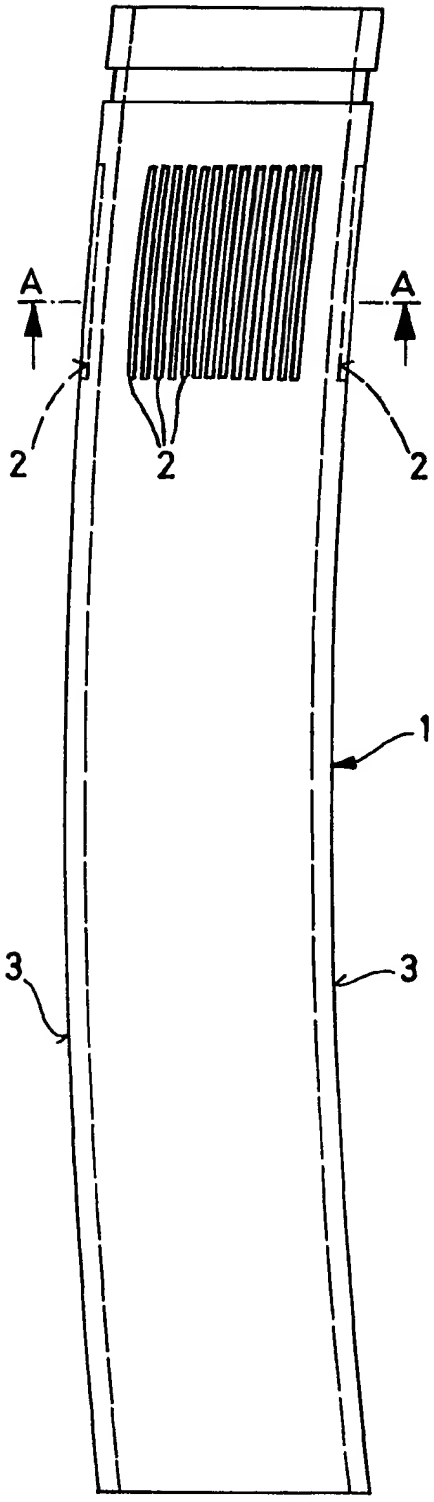


Fig. 2

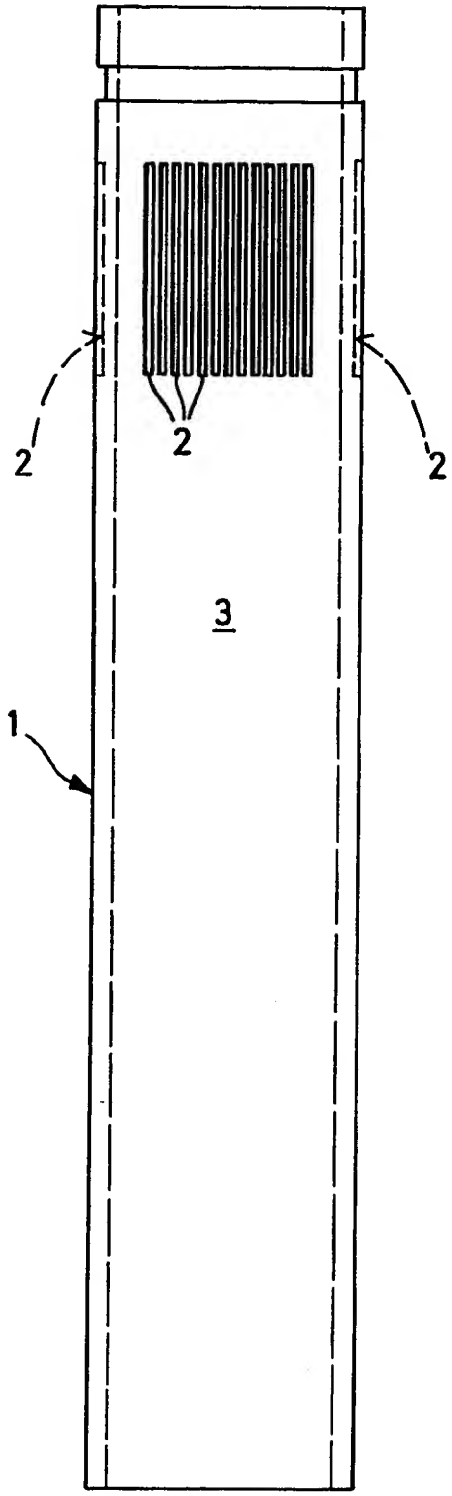
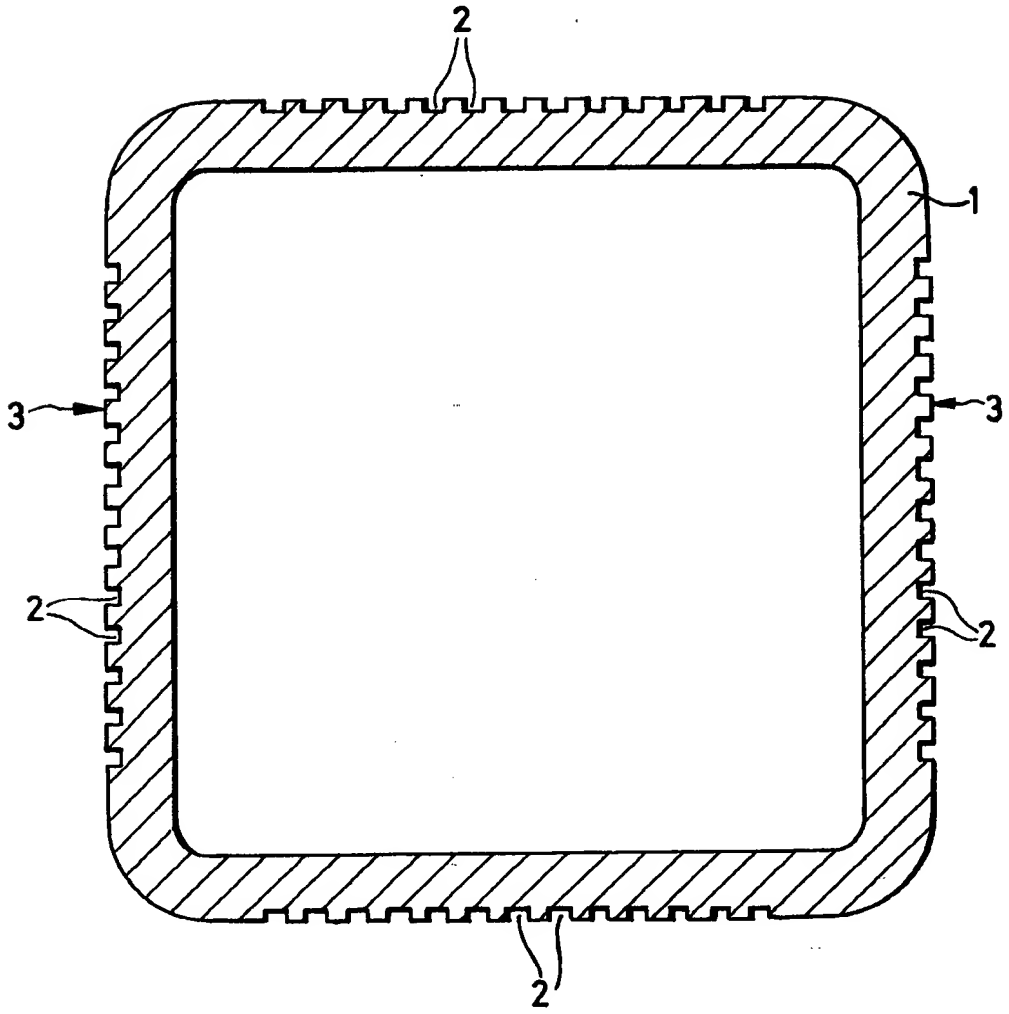


Fig. 3 (A-A)



SPECIFICATION

Mould

The present invention relates to a mould employed in the continuous casting of billets of metals with a high melting point, especially iron and steel.

The moulds conventionally employed in the continuous casting of iron and steel are either one-element or multielement moulds. In cross-section, the moulds are either polygonal or round. One-element moulds are formed of a cylindrical or prismatic tube made for example of deoxidized copper; these kind of tubes are proved to be suitable for the purpose owing to their good heat-conducting capacity.

Practical experiences and several experiments have shown that during the casting operation, thermal strain is directed on the mould walls unevenly in the longitudinal direction. The most intensive thermal strain is directed on the mould wall in the region where the boundary of molten metal fluctuates during the casting operation, as well as in the immediate vicinity of the said region.

In the prior art there have been attempts to speed up the cooling of the billet in the mould by making the inside of the mould conical, either partly or wholly. The conical shape is achieved either by machination, or by corrosion with an acid, as is described for instance in the GB Patent Publication 1 180 174.

The moulds of circular arc type and employed in continuous casting are manufactured either of one or of several parts. Particularly the cooling of a mould made of one part only has so far proved out to be troublesome.

The object of the present invention is to achieve a mould where the above explained problem is solved. In order to realize this, the invention is characterized by the novel features enlisted in the appended patent claim 1.

Because the thermal strain in the mould is most intensive in the region where the molten metal boundary fluctuates, deformations (bulges) may be formed in the mould, and therefore it is advantageous that especially in the region of the molden metal boundary there is arranged cooling which is as effective as possible.

The mould tube blank for billets of steel or other such metal with a high melting point, to be employed in continuous casting machines, can be manufactured by means of casting, hot-extrusion, drawing or in some other suitable fashion.

Th m uld according to the present invention is described with reference to the appended drawings, where

Figure 1 is a side-view illustration of a mould having circular arc type,

Figure 2 is an illustration of the same mould, also in side view but in a position where it has been turned 90° with respect t Fig. 1, and

Figure 3 illustrates the mould of Fig. 1 seen in cross-section along the line A–A.

The mould 1 according to the invention, which mould is provided with grooves 2, can be manufactured in several different fashions. It is proved that the most advantageous method is to form the grooves in connection with the working of the mould blank. Accordingly, the mould blank is bent into form by means of a die, whereafter it is cold-worked by drawing the plug through the blank in an expanding draw, as is described in the Finnish Patent Application No. 842579. The grooved mould is manufactured by arranging grooves on the inner surface of the die so that during the cold-working stage, the grooves are also formed in the mould. The essential point is that in this fashion there is achieved a mould where the longitudinal direction of the cooler grooves 2 is essentially parallel to the central direction of the mould 1.

It was stated above that the heat transfer capacity of the mould wall can be regionally improved by providing the outer circumference of the mould with grooves, the longitudinal direction whereof is roughly parallel to the central direction of the mould. The width and length of the said grooves can be chosen according to the size of the mould. The width of the grooves is preferably between 1–8 mm, and the depth between 0,5–3,0 mm. The length of the grooves is advantageously between 60–600 mm. The front end of the grooves is located at about 60–130 mm from the top end of the mould, or in the case of such grooves that extent almost along the whole width of the mould, the distance of the front and back ends of the grooves is equal both ends.

Apart from the method described above, the grooves 2 can also be formed on the outer surface of the mould by means of cutting working methods, advantageously by employing a CNC miller provided with continuous track control.

In addition to the above described methods, the grooves 2 can be manufactured by employing chemical or electrolytical etching.

It has been proved that it is not absolutely necessary for the cooler grooves to be located along the whole outer circumference of the mould, but, for instance in a rectangular mould, a sufficient cooling can be achieved by providing the arched side surfaces 3 of the mould with the cooler grooves.

CLAIMS

1. A m uld for use in continuous casting machines for billets of steel or other such metal with a high melting point, wherein the outer surface f the mould is provided with intensifying cooler gro ves of defined lengths in th region corresponding to where the molten boundary occurs during the casting pro-

cess.

2. A mould according to claim 1, wherein the mould is a unitary element.

3. A mould according to claim 1 or 2, wherein the mould is a mould of a circular arc type.

4. A mould according to claim 1, 2 or 3, wherein part of the outer circumference of the mould is provided with said cooler grooves.

5. A mould according to any one of claims 1 to 4, wherein the longitudinal direction of each of the cooler grooves of the mould is substantially parallel to the central direction of the mould.

6. A mould according to any one of claims 1 to 5, wherein the width of the grooves is from 1 to 8 mm, and the depth is from 0,5 to 3,0 mm.

7. A mould according to any one of claims 1 to 6, wherein the length of the grooves is between 60 to 600 mm.

8. A mould according to any one of claims 1 to 7, wherein the cooler grooves of the mould are formed during the working of the mould tube blank.

9. A mould according to any one of claims 1 to 7, wherein the cooler grooves of the mould are formed by means of a cutting working method.

10. A mould according to any one of claims 1 to 7, wherein the cooler grooves of the mould are formed by using chemical or electrolytical etching.

11. A mould for use in continuous casting machines for billets of steel or other metal with a high melting point, substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

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